ENERGOPTIONS

OVERVIEW PAPER

INDUSTRIAL SECTOR

Food Processing

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1. INTRODUCTION

Food processing firms in Canada are adopting new technologies to keep their operating costs down and their consumer prices competitive. New energy saving techniques, particularly in the area of heat recovery, have proven enormously successful. Food processors often have large hot water demands, hence condensing heat recovery units can yield significant bottom line improvements with payback periods under three years.

Your colleagues have proven cost reductions and successful operation through demonstrations of these energy saving technologies. Collectively, these projects illustrate a wide variety of cost-saving opportunities existing in the food and beverage sector.

This paper provides an overview of a number of proven measures together with documentation of important lessons learned. Suggestions for appropriate next steps, and details on resources available, are also outlined.

2. OPTIONS

With support from the Federal/Provincial Conservation and Renewable Energy Demonstration Agreements (CREDA) Program, a range of attractive options were demonstrated by industry. Examples follow.

- **Flue Gas Heat Recovery**

  - Over 90% of energy available in natural gas can be recovered with a condensing flue gas heat recovery unit on the plant's main boiler.

- Consider using a small fire-tube boiler as an economizer/heat recovery unit in winter. In summer, or during the "off" season, this small boiler can efficiently supply the plant's reduced energy requirements.

. **Other Heat Recovery Options**

- Heat recovered from cold storage refrigeration equipment can be used for space or water heating.

- Use heat exchangers to recover heat from waste vapour and water streams.

- Heat cooler areas of the plant with air from overheated areas by using circulation fans. When air quality considerations permit, this "thermal averaging approach" will be much more cost-effective than simply exhausting the hot air.

- Consider a water or ground source heat pump to extract heat for space heating and other heating requirements in the facility.

. **Integrated Energy Management**

- Use a computer-based energy controller to minimize plant energy costs.

- A low-cost personal computer connected to an in-plant energy management system can be used to analyze energy use and to identify areas where additional savings can be achieved.

. **Concentrating and Liquid Separation**

- Use reverse osmosis as an energy efficient alternative for concentrating and other liquid separation processes.

- **Drying Applications**

  - Consider high-efficiency indirect heaters to replace direct-fired heaters. These units are over 95% efficient and the hot air produced is virtually free of nitrogen oxides which can cause problems in food drying applications.

  - Recover heat from dryer exhausts and preheat incoming air by using condensing air-to-air heat exchangers.

  - Consider recycling dryer air by using a heat pump to extract heat and moisture from the exhaust air and then transfer the heat to dryer intake air.

- **Cold Storage**

  - Utilize high insulation levels and effective vapour barriers particularly in new cold storage and refrigeration facilities.

3. CREDA DEMONSTRATIONS

The CREDA projects outlined below provide a sample of the many operations for reducing energy consumption and costs in food processing facilities. They provide tangible evidence of significant energy cost savings that can be realized in plants and also provide information on practical installation and operation procedures.

The demonstration project Case Studies contained in this ENEROPTIONS package are:

MAN 15 Direct Contact Condensing Heat Recuperator - Winnipeg, Manitoba

A condensing flue gas heat recovery unit, installed by Canada Packers, paid for itself in reduced operating costs in less than three years. The system recovers waste heat from natural gas fired boiler flue gas and transfers it to the plant process hot water supply.

ONT 45 Low Temperature Flue Gas Heat Recovery System - Welland, Ontario

John Deere Ltd. installed a Beckett Heat Recovery System which saved the company over $35,000 annually. In winter, a standard fire-tube boiler is used as an economizer with flue gas being cooled to slightly above the dew point. In summer, or during the "off season", the same unit serves as a compact, economical steam source for the plant's reduced requirements. Similar units are installed in the Welland Hospital and at Carleton University in Ottawa.

MAN 24 Energy Efficient Cold Storage - Portage la Prairie, Manitoba

In their new facility, Westco Storage Limited reduced their per unit energy consumption by an impressive 76%. Heat recovery from the refrigeration system plus increased insulation levels are incorporated into the new building's design.

SASK 20 Rendering Vapour Heat Recovery System - Moose Jaw, Saskatchewan

Twenty per cent of fuel costs is saved yearly with the installation of a condensing heat recovery system on rendering vats at a Canada Packers plant. The success of the technology has lead to further installations.

ONT 60 Vertical Loop Ground-Source Heat Pump - Toronto, Ontario

Existing oil-fired boilers in an industrial shop facility were replaced with glycol-to-water heat pumps which extract heat from the ground using a series of vertically-buried loops.

NB 36 Integrated Energy Management System - Black's Harbour, New Brunswick

A programmable process controller linked to a remote microcomputer is used to monitor, analyze and control energy use at the Connors Bros. Ltd. sardine cannery. Recycling and recovery of heat from plant air and water coupled with electrical demand and power factor control result in annual savings of over $79,000.

ONT 15 Maple Syrup by Reverse Osmosis - Ontario and Nova Scotia

Memtek Corp. installed and monitored ten sets of reverse osmosis maple syrup concentrators. This pre-treatment technique saves up to 80% in energy costs and produces prize-winning syrup. The technology is applicable to many other concentrating and fluid separation processes.

SASK 12 High Efficiency Indirect Heaters and Air-to-Air Heat Exchangers - Biggar, Saskatchewan

Prairie Malt Limited replaced direct-fired malt drying kiln heaters with high efficiency, indirect heaters and recovered heat from the kiln exhaust using condensing air-to-air heat exchangers. Malt quality is improved and kiln fuel costs are reduced by a significant 38%.

NFLD 17 Fish Dryer Heat Pump Conversion - Cupids, Newfoundland

A recirculating heat pump system was installed to replace a single-pass, oil-fired fish dryer at the Canadian Saltfish Corporation plant. Fourty-three per cent of the cost of drying fish, or $24,800 per year, was saved.

Many other applicable projects have been undertaken. Contact your nearest federal or provincial energy office to learn more about nearby projects or those in applications similar to yours.

4. LESSONS LEARNED

Flue Gas Heat Recovery. A direct contact condensing flue gas heat recovery unit after a natural gas fired boiler can provide a payback period under three years.

The cost of this condensing type unit is reduced by using direct contact water spray to recover heat from the flue gas and by using plastics where possible rather than costlier corrosion-resistant metals.

In non-condensing units, maximum heat recovery is attained by closely controlling the temperature of the flue gas so that it remains close to, but safely above, the dew point in order to avoid acid corrosion.

Other Heat Recovery Options. The economics of low grade heat recovery are site specific and highly dependent upon the available uses for the recovered heat.

Uses for the recovered heat, such as pre-heating water, should be in close proximity to the heat recovery units to minimize the length of costly interconnecting pipes or ducts.

The load profile for the recovered heat should be fairly close to that of the supply and the higher the daily capacity factor, the better.

Integrated Energy Management. Savings from the control of electrical demand and power factor can go a long way toward justifying a computer-based energy management system. Once installed, this unit can monitor and control other functions, such as heat recovery.

A personal computer can be used to store and analyse data from an in-plant energy management system if care is taken to insure that the communication hardware and software linking the two machines are fully compatible.

Computerized energy monitoring and analysis greatly facilitate the identification of additional conservation measures.

Availability of hard data on actual savings can make it easier to justify investment decisions to senior management.

To avoid possible incompatibility problems, when acquiring computerized systems, specifications should be prepared on a functional basis rather than specifying individual pieces of equipment.

Concentrating and Liquid Separation. Concentrating or separating liquids via reverse osmosis involves the use of a special membrane between dilute and concentrated solutions and a special high-pressure pump. This advanced technology has been found to be both reliable and cost-effective even in remote, natural maple syrup production locations where on-site technical backup is generally non-existent.

Drying Applications. High efficiency indirect heaters are quite new. Risks will be reduced if equpment with a proven track record is selected.

When using condensing air-to-air heat exchangers to recover heat from dryers and to preheat fresh air, icing can occur during cold weather. This problem can be managed through the correct design of ducting and control equipment (e.g., bypassing the heat exchanger when ambient temperature falls below a certain set point). Even with the reduced effectiveness encountered during winter, condensing air-to-air heat exchangers have been found to be cost-effective in many preheating applications.

When existing oil-fired dryer heaters need replacement, heat pump based dryers may be particularly attractive.

Cold Storage. Damage to stored products that can occur during power outages can be greatly reduced by increasing insulation levels in cold storage facilities.

A good vapour barrier substantially reduces defrosting requirements.

5. NEXT STEPS

The demonstration case studies contained in this ENEROPTIONS package present some of the approaches which are applicable in the food processing sector. It is hoped that they will benefit you by:

- indicating applications that may be relevant to you and your organization,
- presenting an accounting of actual benefits and actual problem areas which you can expect should you pursue a similar initiative.

To assist you, several "next steps" are suggested below:

- Obtain free copies of final reports on the projects that are of interest from addresses indicated at the end of the case studies.
- Contact the appropriate demonstration project manager or equipment supplier listed in the case study to obtain further information.
- Establish administrative responsibility for energy consumption and costs in your plant or firm.
- Undertake an energy audit to identify the appropriate package of measures for your plant.
- If you lack the necessary in-house engineering resources to identify and implement the appropriate package of measures for your facility, you should consider retaining the services of a qualified engineering consultant.

6. RESOURCES AVAILABLE

Free technical reports are available for most of the CREDA projects listed above. Addresses of appropriate contacts for follow-up, including equipment suppliers and system designers, are listed at the end of each of the attached ENEROPTIONS Case Studies under the "Further Information" section.

The departments or ministries of energy in each province or territory have information on energy conservation and alternative energy and may also have assistance programs. Check your telephone directory for apropriate contact people.

The Conservation and Renewable Energy Offices (CREOs) of Energy, Mines and Resources Canada in each province and territory have information on federal demonstrations, and other assistance programs. Check the back of the attached file folder for the office in your area.

Information on qualified engineering firms and the "Recommended Procedure for the Selection of an Engineer to Provide Professional Services" can be obtained from:

(a) The association of Consulting Engineers of Canada
(Re: ENEROPTIONS)
Suite 616
130 Albert Street
Ottawa, Ontario
K1P 5G4
(613) 236-0569

(b) The consulting engineering organization in each province.

Information on innovative financing arrangements can be obtained through the government departments listed above and/or contacting:

Martin Adelaar
(RE: ENEROPTIONS)
Energy Management Advisor
Energy Conservation and Oil Substitution Branch
Energy, Mines and Resoures Canada
580 Booth Street
Ottawa, Ontario
K1A 0E4
(613) 995-1118